Alaska Department of Transportation & Public Facilities

Implementing Energy Efficiency Improvements

Energy Efficiency NOW:

An Energy Performance Conference for Commercial and Public Buildings

Statewide Public Facilities

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Presenters

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“Alone we can do so little; together we can do so much.”

-Helen Keller

Topic Overview

- DOT&PF Energy Office Introduction
- Prioritizing & Assessing
- Project Approaches
- Funding Options
- Project Example - *Mt. Edgecumbe High School*

DOT&PF Energy Office

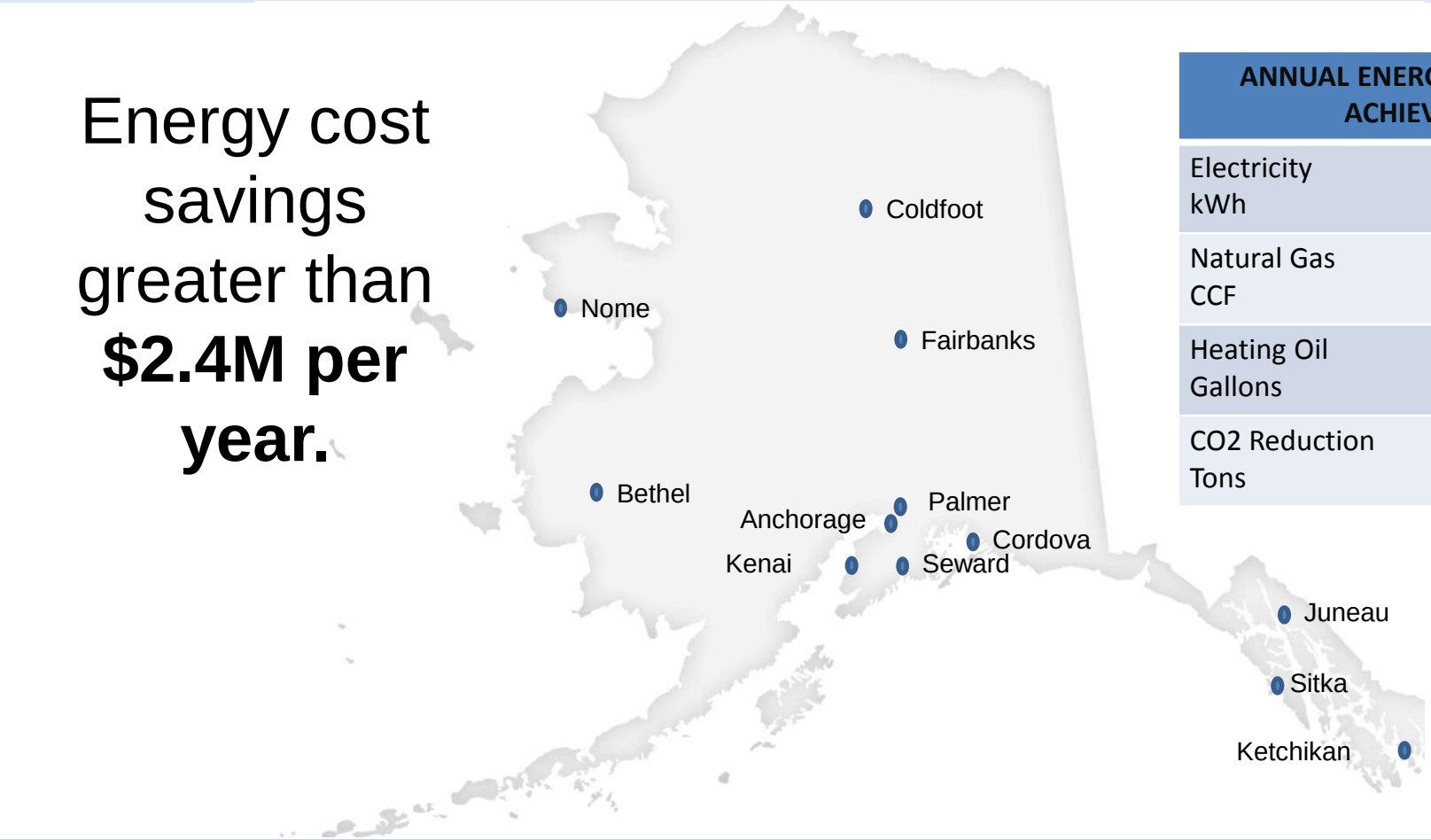
- Manages Energy Savings Performance Projects to serve DOT&PF and our State Agencies
- Projects completed in over 50 state buildings
- Achieved statutory requirement to perform energy efficiency retrofits in at least 25% of State public buildings 10,000 square feet or larger

Services Provided

- Assessment and comprehensive energy audits
- Project development, life cycle cost analysis and facilitating project financing options
- Project execution and management
- Monitoring of completed projects to ensure that they have met their energy efficiency goals

DOT&PF Energy Office

Energy cost savings greater than **$2.4M per year.**



ANNUAL ENERGY SAVINGS ACHIEVED	
Electricity kWh	> 7,700,000
Natural Gas CCF	> 162,000
Heating Oil Gallons	> 237,000
CO2 Reduction Tons	> 9,500

Prioritizing & Assessing

Prioritizing

- Aging or failing equipment.
- You notice high utility consumption or costs.
- Benchmarking your building to determine your Annual Energy Use Index (EUI)
  - Against your other buildings,
  - Other buildings in Alaska with ARIS
  - Nationwide with EPA Portfolio Manager or Energy Information Administrations Commercial Buildings Energy Consumption Survey (CBES)

Prioritizing & Assessing

Assessing your situation

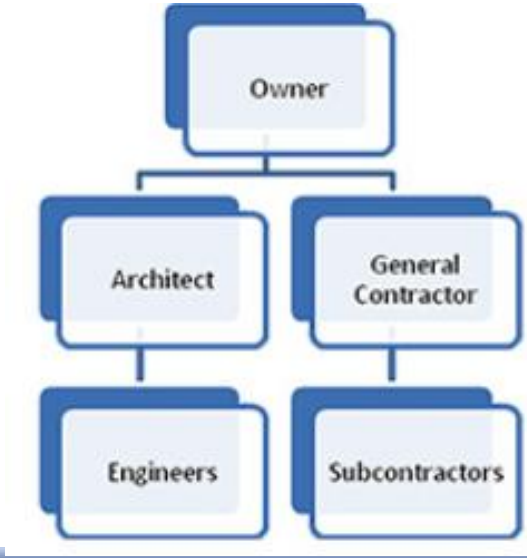
- Conversations with the maintenance manager
- ASHRAE Level 1 walk-through:
  - Analyze energy bills
  - Conduct a brief on-site survey of the building
  - Identify and provide a savings and cost analysis of low-cost/no-cost measures
  - Provide a listing of potential capital improvements that merit further consideration
  - An initial judgment of potential costs and savings.

Project Approaches

- Two most common delivery methods
  - Design – Bid – Build
  - Design – Build
- Delivery method used for energy projects
  - Energy Savings Performance Contract

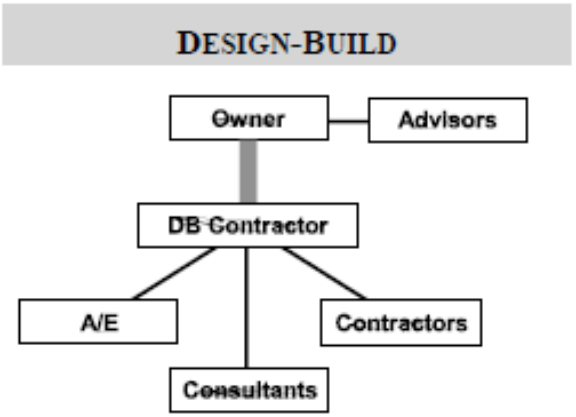
Types of Contracts
Design – Bid – Build

- Recognizable by all designers and contractors
- Slow process (must bid design, develop bidding package, bid construction, construct work)
- Owner contracts directly with Designer and Contractor
- Firm scope of work upfront
- Change orders
- Known budget
- High amount of clarification during construction



Types of Contracts
Design-Build

- Owner hires Contractor to do both design and construction
- Usually bid with some design completed
- Scope of work defined, but changes may be made
- Known budget
- Change orders less likely



Energy Savings Performance Contracting

- Contractor is an Energy Services Company
- Multiple funding sources can be used
- May be paid for from energy savings realized
- All parties cooperatively develop the scope of work
- Design doesn't have to be complete to order long-lead items
- Savings may be guaranteed
- Guaranteed Maximum Price
- Open book pricing
- ESCO assists with financing

Funding Options

Appropriation/Grant

- Don’t have to pay back
- Specific amount
- Realize savings immediately
- Possible delay waiting for funding approval

Financing

- Have to pay back with interest
- Don’t realize the savings until after loan repayment
- Budget neutral repayment

Mt. Edgecumbe High School

- Sitka, Alaska
- Operated by the Department of Education & Early Development since 1985
- Alaska's only public boarding school

Mt. Edgecumbe High School

Campus includes ten buildings

The Situation

- Failing heating infrastructure
- Had to run heating plant all year to minimize leaks
- Campus facilities in immediate need to prevent potential closures
- Excessive energy use in campus because of failing infrastructure
- No automated controls for campus
- Could not separate energy use for some groups of buildings

Benchmarking the Project

- Used 3 years of utility data (2009 – 2012)
- Campus Average Energy Use Index– 128 kBTU/SqFt

Campus Segment	Building # – Facility Name	Square Feet	CBECS Average 50%	CBECS Aggregate Average 50%	Actual EUI (kBtu/sf²)
Boiler Plant Supplied Buildings	289 – Central Heating Plant	3,978	89	121.3	128.1
	290 - Cafeteria	16,355	210.2		
	292 – Boys Dorm	25,808	128.7		
	293 – Girls Dorm	32,142	128.7		
	295 – Heritage Hall	24,000	128.7		
	297 – Ivy Hall	16,080	128.7		
	1330 – Classroom Bldg	24,120	86.1		
	1331 – Gymnasium	53,294	98.6		
Other Buildings	299 – Classroom & Maintenance Warehouse	20,400	19.9	39.4	82.6
	301 –Maintenance Shop	10,500	45.1		

The Project Approach

- An Energy Savings Performance Project Approach was chosen
  - Faster project delivery to address immediate critical needs
  - Cooperative project development
  - Scope work based on specific needs and funding
  - One contractor for development, implementation and verfification

Selecting the Energy Service Company

- Request for Proposal using the DOT&PF Energy Performance Contract Term Agreement
  - Qualitative and Quantitative selection criteria
- Must be able to deliver a minimum Level III ASHRAE Energy Audit with Guaranteed Savings
- Needed a contractor that could deliver immediate assistance –providing temporary heat or repairs to the campus if needed
- Siemens Industries, Inc. was selected

Project Summary

- An Investment Grade Energy Audit & Energy Services Proposal for the entire campus
  - Energy Efficiency Measures (EEMs) developed for the entire campus
- Implementation completed in two phases over two years
  - Phase I – upper campus heating plant & new upper campus heating distribution
  - Phase II – campus-wide energy upgrades
- State Appropriation

Investment Grade Energy Audit & Energy Services Proposal

- Energy Efficiency Measures (EEMs) Selected
  - Heating Plant Upgrades
  - Hydronic and Domestic Hot Water line campus distribution

Phase I Implementation $1.8M

  - Campus-wide direct digital control (DDC) upgrades
  - Continued piping upgrades and distribution extensions on the campus
  - Digital Energy Meters – BTU and Electric meters
  - Campus-wide variable speed/volume pumping and piping upgrades.
  - Central plant domestic hot water upgrades

Phase II Implementation $3.0M

- Post project Measurement & Verification

Evaluating the Proposed Energy Efficiency Measures

EEM DESCRIPTION	ELECTRIC SAVINGS $	ELECTRIC SAVINGS kWh	FUEL OIL SAVINGS $	FUEL OIL SAVINGS GALLONS	REPAIR SAVINGS $	TOTAL ANNUAL SAVINGS $	TOTAL ANNUAL OPERATIONAL SAVINGS $	IMPLEMENTATION COST $	SIMPLE PAYBACK YEARS	ROI %	CO2 REDUCTION LBS
Hydronic Heat Piping Replacement	$883	7,797	$2,608	652	$20,000	$3,491	$20,000	$272,549	11.6	9%	25,994
Utilidor Piping Extension to Upper Heating Plant	$0	-	$19,544	4,886	$0	$19,544	$0	$129,919	6.6	15%	109,368
Campus Wide DDC Upgrade	$3,374	28,907	$131,556	32,889	$30,000	$134,930	$30,000	$1,747,162	10.6	9%	778,451
Digital Energy Meters - BTU & Electric	$0	-	$3,736	934	$0	$3,736	$0	$72,167	19.3	5%	20,907
Variable Volume Pumping & Piping Upgrades	$13,180	116,324	$0	-	$10,000	$13,180	$10,000	$445,174	19.2	5%	170,073
End of Construction Report								$32,238			
Construction Subtotal =	**$17,437**	**153,027**	**$157,444**	**39,361**	**$60,000**	**$174,881**	**$60,000**	**$2,699,209**	**11.5**	**9%**	**1,104,793**
Annual DDC Service								$22,492			
Energy Project Total =	**$17,437**	**153,027**	**$157,444**	**39,361**	**$60,000**	**$174,881**	**$60,000**	**$2,721,701**	**11.6**	**9%**	**1,104,793**

Evaluating the Proposed Energy Efficiency Measures

- Each project has its unique needs
  - Prioritize yours
- Understand the technology – very important
  - Is it proven… will it last?
- Understand the costs
  - Engineering, construction, management and many other costs.
- Owner commitment to the technology, maintenance and training

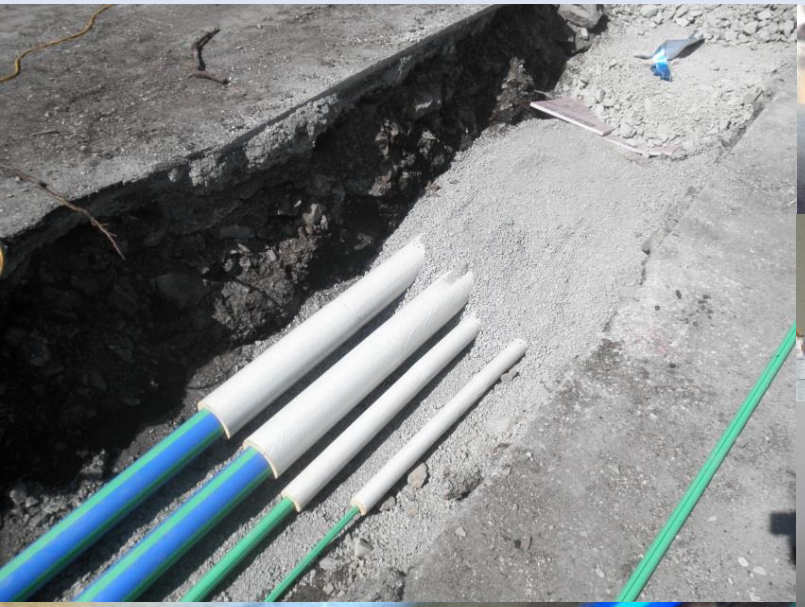
Implementation – Phase I

- Immediate focus on the heating plant and campus distribution with development from December 2012 – March 2013
- New boilers and campus distribution installed while old boilers were still operating.
- Construction Agreement issued March 2013 & new system fully operational in August 2013

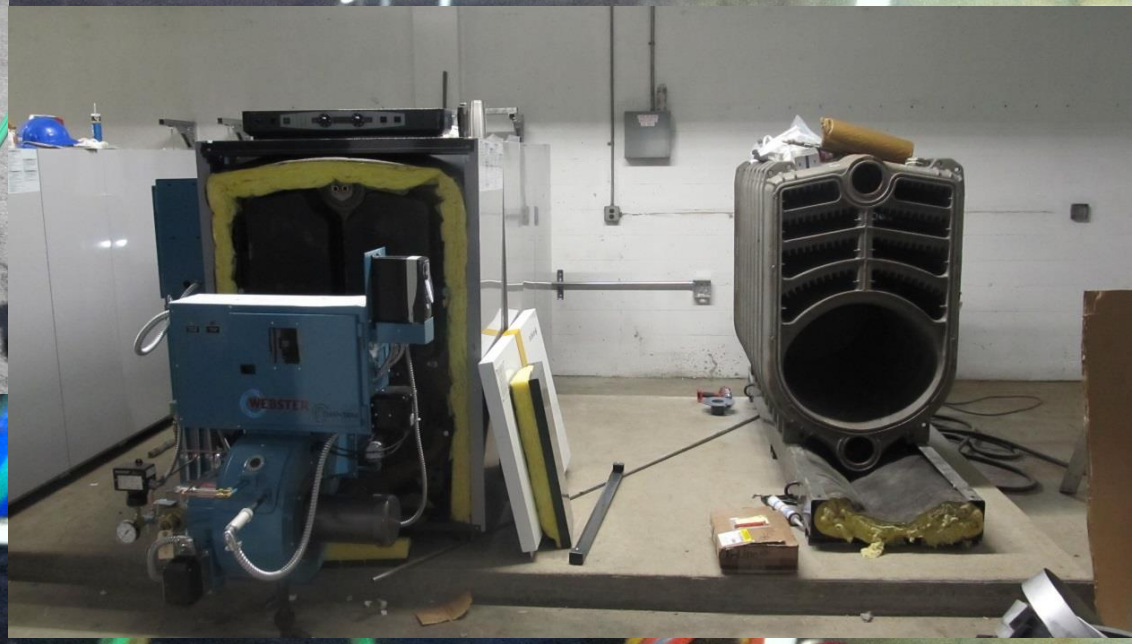




Implementation – Phase I



Hydronic distribution and domestic hot water distribution piping



New higher efficiency boilers with DDC controls

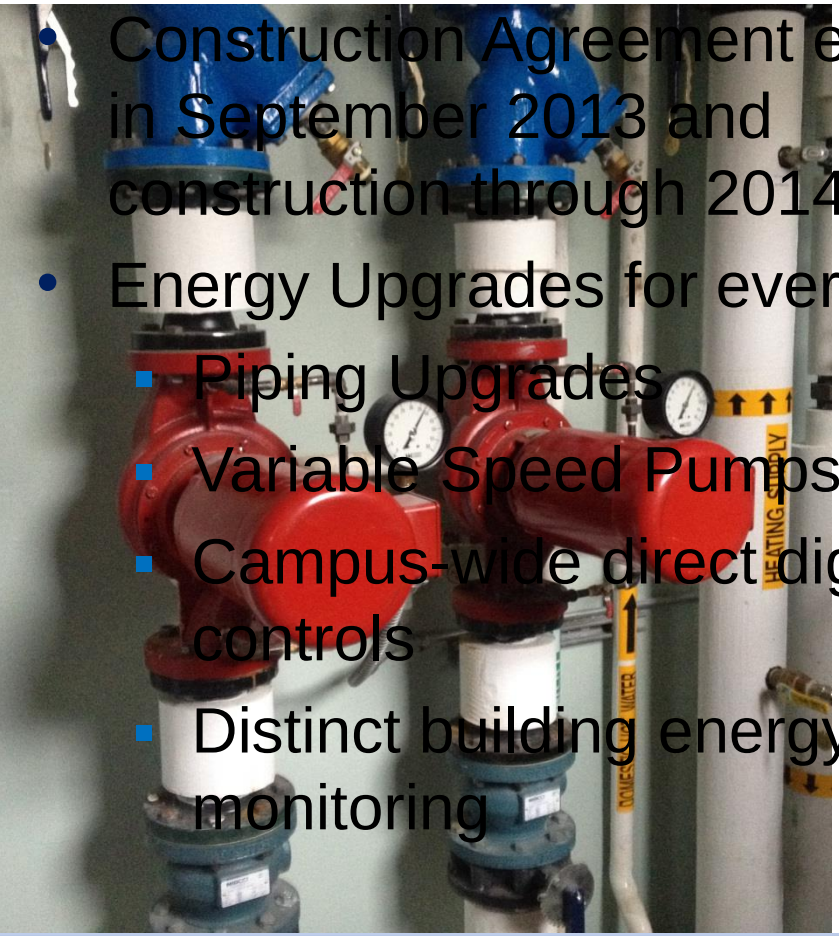
Commissioning / Start-up – Phase I

- The designer, Siemens, product manufacturer, and owner all involved with the commissioning and startup process

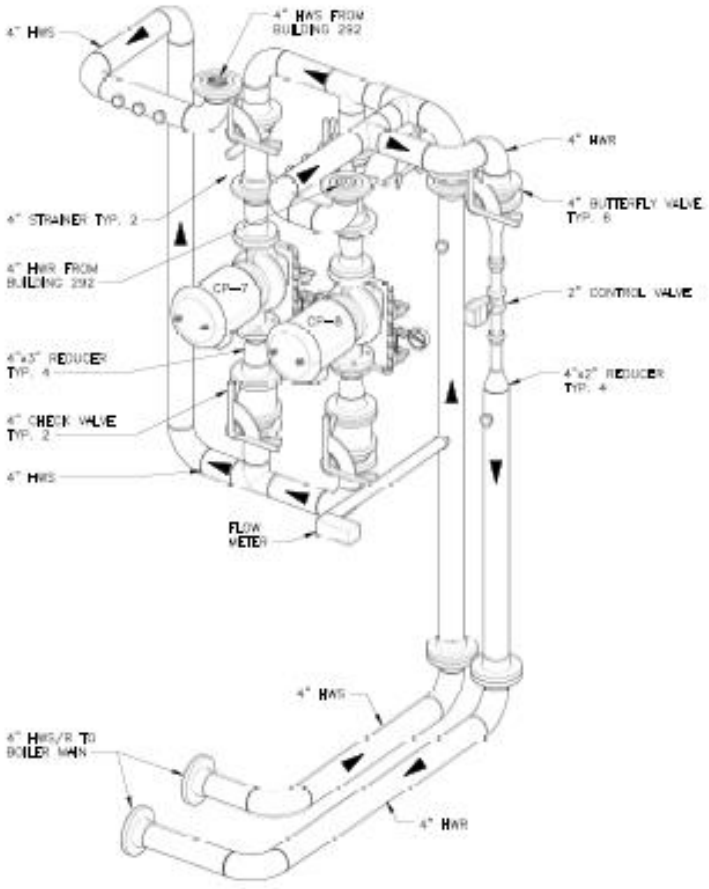
Completed boiler upgrades

DDC boiler controls and VFD Pump Controls

Implementation – Phase II

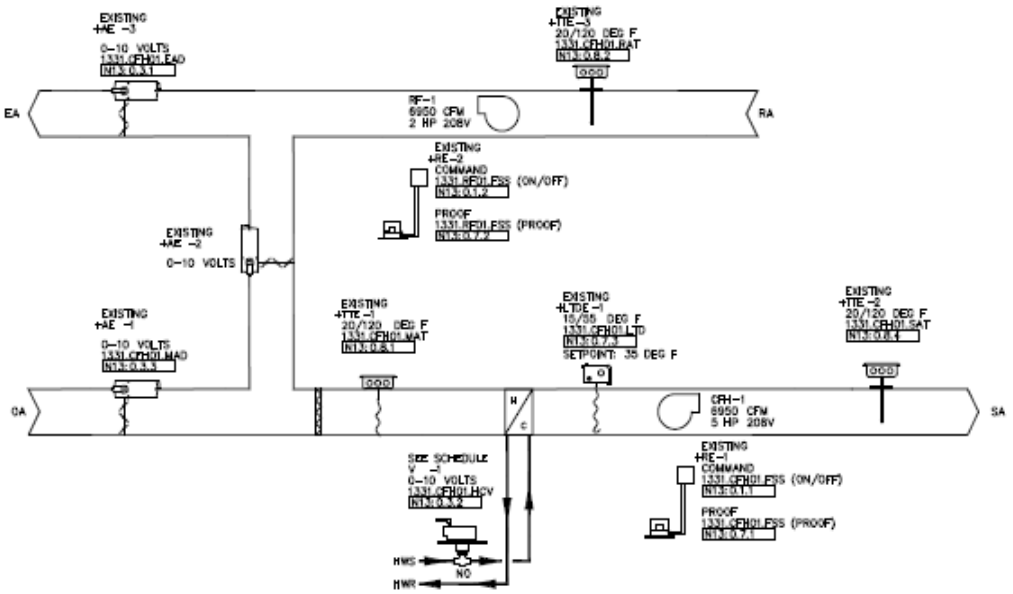


- Construction Agreement executed in September 2013 and construction through 2014
- Energy Upgrades for every building
  - Piping Upgrades
  - Variable Speed Pumps
  - Campus-wide direct digital controls
  - Distinct building energy monitoring



Commissioning / Start-up – Phase II

- Designer, Siemens, Owner all involved
- Comprehensive owner training of all systems
- Trending and monitoring of the systems for correct operations



ESPC vs Design-Bid-Build

- For lower campus heating plant
  - Method - *Design-Bid-Build Contract*
  - Approximately 2.5 years from initial design through construction completion
- For upper campus heating plant
  - Method - *Energy Savings Performance Contract*
  - *Approximately 9-months from initial development through construction completion*

Project Results

- Measurement and Verification from Phase I showed greater than anticipated savings
- Results from both phases of construction:
  - Total Annual Fuel Oil Savings: > 68,000 Gal
  - Total Annual Elect. Savings: >157,000 kWh
  - Total Annual Energy Savings: > $330,000

Energy Efficiency Examples

- ***Energy Efficiency Improvement Examples:*** *Lighting Upgrades*

Before

After

At Mt. Edgecumbe High School (Sitka) – new high efficiency fluorescent lights were installed in the Gymnasium-both reducing energy use and dramatically improving the gym environment.

On-Going Energy Management

- Individual building energy data now possible for each building on campus with new digital energy meters through the Campus DDC system
- Energy consumption data can be stored and results reported in the Alaska Retrofit Information System (ARIS)

For Further Information

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Thank you for your attention and this opportunity.